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PENSOFT

Freshwater shrimps (Crustacea, Decapoda, Caridea, Dendrobranchiata) from Roraima, Brazil: species composition, distribution, and new records

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Abstract

This work provides an update on the species composition and distribution of freshwater shrimps from the state of Roraima, Brazil, based on material deposited in the Brazilian collections of the Instituto Nacional de Pesquisas da Amazônia (Manaus) and the Museu Integrado de Roraima (Boa Vista). A total of 12 species (1 Sergestidae, 3 Euryrhynchidae, and 8 Palaemonidae) are listed, of which 7 (*Acetes paraguayensis* Hansen, 1919; *Euryrhynchus amazoniensis* Tiefenbacher, 1978; *E. burchelli* Calman, 1907; *E. wrzesniowskii* Miers, 1877; *Palaemon yuna* Carvalho, Magalhães & Mantelatto, 2014; *Pseudopalaemon chryseus* Kensley & Walker, 1982; and *Ps. gouldingi* Kensley & Walker, 1982) are recorded for the first time from the state of Roraima. Maps of geographic distribution for all species known from the state are offered.

Key words

Amazon region; Euryrhynchidae; Neotropical region; Palaemonidae; Sergestidae; taxonomy.

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Introduction

Despite the number of studies addressing the taxonomy and geographic distribution of the Amazonian freshwater shrimps (Holthuis 1951, 1952, 1966, Omori 1975, Tiefenbacher 1978, Kensley and Walker 1982, D'Incao and Martins 2000, Magalhães 2002, Melo 2003, García-Dávila and Magalhães 2004, Pileggi et al. 2013, Pimentel and Magalhães 2014), the diversity of these decapods in the state of Roraima is still poorly known in the carcinological literature. Ramos-Porto and Coelho (1998) made the first mention of a species of shrimp in Roraima by simply listing the state in the geographical distribution of *Macrobrachium nattereri* (Heller, 1862) in a faunistic catalogue. However, this record cannot be confirmed as the authors did not document it; that is, the specific locality and other collecting data as well as the repositories of the voucher material were not informed. Melo (2003) did not relate voucher material when listing the state as part of the geographic distribution of *M. ferreirai* Kensley & Walker, 1982, and *M. nattereri*. The first documented

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record was published only recently by Pileggi et al. (2013) for *Macrobrachium amazonicum* (Heller, 1982), from the lower Branco River basin. Shortly thereafter, Castro and Silva (2013) recorded *M. brasiliense* (Heller, 1862), *M. inpa* Kensley and Walker, 1862 (= *M. brasiliense*), and *M. nattereri*, in addition to 3 morphospecies of *Macrobrachium*, from the "igarapé" Perdido, in the municipality of Mucajaí. Later, Cavalcante and Castro (2014) found *M. jelskii* Miers, 1877 in fish culture reservoirs in the municipality of Alto Alegre.

In Roraima, the rapid deterioration of aquatic environments due to deforestation and siltation of water bodies has increased, especially in areas of forests and savannahs located outside the boundaries of protected areas (Fearnside 1997, Barbosa et al. 2007), contributing to a possible loss of decapod diversity due to habitat degradation. The purpose of this study is to update the information on the taxonomic composition and geographical distribution of freshwater shrimps from Roraima, as well as to report new records from the state and to provide baseline information for future studies or eventual conservation actions.

Methods

Study site. The state of Roraima (225,116 km²), in northern Brazil between the geographic coordinates 05°16′ N and 01°25′ S, and 058°55′ W and 064°48′ W (Ferreira et al. 2007), is part of the Amazon-Orinoco interfluvium (Franco et al. 1975) and is characterized by 2 main vegetation types, savannah (open areas) and forest areas (Barbosa 1997).

The main drainage system in Roraima is the Branco River, a tributary of the left bank of the Negro River, with a watershed of 187,540 km² (of which 12,310 km² are situated in Guyana), comprising 83% of the state territory (Carvalho 2015). The confluence of the Uraricoera and Tacutu rivers gives rise to the Branco River, and most of their respective tributaries originate in the Parima-Pacaraima mountainous complex along the Venezuelan-Brazilian border. The 566-km-long Branco River flows through the state in a northeast-southwest direction. Its main tributaries are: the Cauamé, Mucajaí, Água Boa, and Catrimani rivers on the right bank; and the Quitauau and Anauá rivers, as well as their tributary, the Baruana River, on the left bank. The Xeruini, Jauaperi, and Jatapu rivers cover the remainder of the south and southeastern portion of Roraima's territory (Santos et al. 1985, Ferreira et al. 2007, Carvalho 2015).

Data collection. The list of species was based both on unpublished data from material previously deposited in the Brazilian carcinological collections of the Instituto Nacional de Pesquisas da Amazônia, Manaus (INPA), and the Museu Integrado de Roraima, Boa Vista (MIRR), as well as material collected during field trips carried out between April 2014 and April 2015 in several municipalities in the state of Roraima: Alto Alegre, Amajarí, Boa Vista, Bonfim, Cantá, Caracaraí, Caroebe, Iracema, Mucajaí, Normandia, Pacaraima, Rorainópolis, São João da Baliza, and São Luís do Anauá. Fresh material was preserved in 70% ethanol. All sampling was made according to the permit issued by ICMBio (SISBIO # 47494-1).

Taxonomic and distributional analysis. Generic and specific identifications were made according to the morphological descriptions and keys in Holthuis (1951, 1952), Omori (1975), Tiefenbacher (1978), Kensley and Walker (1982), D'Incao and Martins (2000), Melo (2003), and García-Dávila and Magalhães (2004), and by comparison with identified material of the INPA collection. The "identification characters" listed under each species apply for adult specimens; these characters must be considered with great care regarding juveniles or subadults specimens. Suprageneric classification follows Ahyong et al. (2011), and the taxa are organized alphabetically. The distributional maps are based on geographical coordinates obtained from a GPS receiver during the sampling and from the labels of the collection lots. The geographic coordinates informed between brackets represent the municipality for lots lacking specific site location. The maps were obtained using the QGIS software, v. 2.14.16 (Quantum GIS Development Team 2017) according to the instructions presented in the second part of the tutorial by Calegari et al. (2016). For generating the maps, coordinates were all converted to decimal degrees using WGS84 datum (the same used in the GPS receiver employed during the sampling) according to the calculator provided by INPE (2017).

Conventions. The following abbreviations are used in the text: CL = cephalotorax length (measured dorsally from anterior margin of orbit to the posterior margin of carapace; immat. = immature(s); juv. = juvenile(s); ovig.= ovigerous; P = pereopod; Plp = pleopod; and spec. = specimen(s). In "Material examined" the names of geographic elements were kept as written in the original label in Portuguese and mean: cachoeira = falls; fazenda = farm; igarapé = small river; lago = lake; praia = beach; rio = river; sítio = small farm; vicinal = side road; and vila = village.

Results

The freshwater shrimp fauna of the state of Roraima is currently comprised of 12 species classified into 2 suborders, 3 families, and 5 genera according to the discrimination that follows. Among these 12 species, 7 are recorded for the first time from the state of Roraima: *Acetes paraguayensis* Hansen, 1919; *Eurybrynchus amazoniensis* Tiefenbacher, 1978; *E. burchelli* Calman, 1907; *E. wrzesniowskii* Miers, 1877; *Palaemon yuna* Carvalho, Magalhães and Mantelatto, 2014; *Pseudopalaemon chryseus* Kensley and Walker, 1982; and *Ps. gouldingi* Kensley and Walker, 1982.

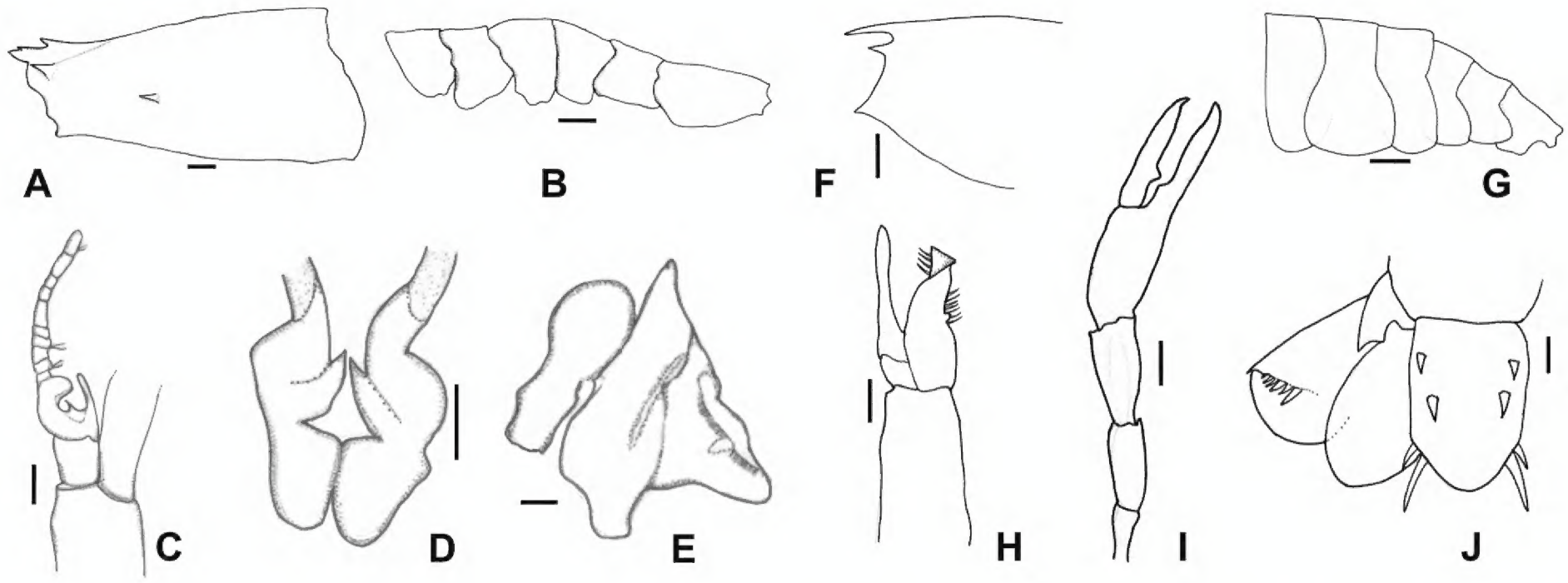

Figure 1. Schematic illustrations of *Acetes paraguayensis* Hansen, 1919. **A.** Carapace and rostrum, lateral view. **B.** Abdomen, lateral view. **C.** Lower antennular flagellum. **D.** Basal segments of third pereopods and third thoracic sternite, ventral view. **E.** Petasma. Schematic illustrations of *Euryrhynchus amazoniensis* Tiefenbacher, 1978: **F.** Rostrum and anterolateral portion of carapace, lateral view. **G.** Abdomen, lateral view. **H.** Second pleopod. **I.** Second pereopod. **J.** Left uropods and telson. Scale bars: A–D, F–J = 5 mm; E = 2 mm.

Order Decapoda Latreille, 1802
Suborder Dendrobranchiata Spence Bate, 1868
Family Sergestidae Dana, 1852
Genus *Acetes* H. Milne Edwards, 1830

Acetes paraguayensis Hansen, 1919 (Figs 1A–E, 6)

Identification characters (Fig. 1A–E). Rostrum very short, with 2 teeth. Carapace and abdomen smooth; pleura of the second somite not overlapping those of the first and third somites. P3 with coxa bearing sharp protuberances (in males; nearly blunt in females). Lower antennular flagellum 8–11-segmented. Petasma small, translucid, bearing a sharp point at the end and no hooks or tubercles distally in the capitulum.

Material examined. 1 male (INPA 2325), Rorainópolis, rio Jauaperi, BR 174 road, 00°30′51.2″ N, 060°27′54.9″ W, 29-IV-2015, colls. F.C. Zanetti, M.A.L. Santos, P.M. Castro, S.C. Emídio and A.R. Lima; 5 females (INPA 2322), Rorainópolis, rio Jauaperí, 02-X-1984, coll. unknown.

Distribution. Venezuela, Colombia, Brazil (Amazonas, Goiás, Pará, Mato Grosso, Roraima [new record]), Peru, Bolivia, Argentina (see Pileggi et al. 2013 for references; present study). The distribution in Roraima is depicted in Figure 6.

Remarks. The morphology of our specimens agrees quite well with the description provided by Omori (1975), although the number of segments in the lower antenullar flagellum of the females are smaller than that found by Omori (1975) (13–17 segments). However, this difference might represent intraspecific variation and needs to be further investigated.

Suborder Pleocyemata Burkenroad, 1963
Infraorder Caridea Dana, 1852
Family Euryrhynchidae Holthuis, 1950
Genus *Euryrhynchus* Miers, 1877

Euryrhynchus amazoniensis Tiefenbacher, 1978 (Figs 1F–J, 7)

Identification characters (Fig. 1F–J). Rostrum triangular, depressed, unarmed, usually not reaching distal margin of cornea. Carapace smooth, antennal tooth present; abdomen smooth, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin convex, its posterolateral angles with 2 pair of spines, inner pair distinctly larger than outer one. P2 (second pair of chelipds) similar in shape, not in size; merus spineless, carpus with small, sharp spine on inner distal margin. Male Plp2 with endopod shorter than exopod, with short row of setae on inner margin starting near to appendix interna, apex flattened, provided with a few setae subdistally on outer margin.

Material examined. 1 male (INPA 2382), Bonfim, BR 401 road, igarapé Arraia, 03°21′05″ N, 059°54′12″ W, date unknown, colls. V. Py-Daniel et al.; 1 male (INPA 2405), Caracaraí, vila Petrolina do Norte, Viruá National Park, [01°42′25″ N, 061°10′24″ W], lower rio Branco basin, 19-VII-2008, coll. J.D. do Vale; 8 males, 18 females (4 ovig.) (INPA 2360), Caracaraí, Caicubi, igarapé Canuini, 01°00′33.1″ S, 061°55′13.3″ W, tributary of rio Jufari, lower rio Branco basin, 11-VI-2013, coll. F.C. Zanetti; 2 males, 12 females (6 ovig.) (INPA 2330), Caracaraí, Terra Preta, igarapé Marixi, 00°50′52.916″ N, 061°57′51.778″ W, tributary of rio Xeriuini, lower rio Branco basin, 25-III-2014, colls. M.A.L. Santos and F.C. Zanetti; 63 spec. (INPA 2324), Caracaraí, Terra Preta, rio Xeriuini, 00°33′54.731″ N, 061°57′9.945″ W, lower rio Branco basin, 25-III-2014, colls. M.A.L. Santos and F.C. Zanetti.

Distribution. Venezuela, Colombia, Brazil [Amazonas, Amapá, Pará, Roraima [new record]), Peru (see Pimentel and Magalhães 2014 for references; present study). The distribution in Roraima is depicted in Figure 7.

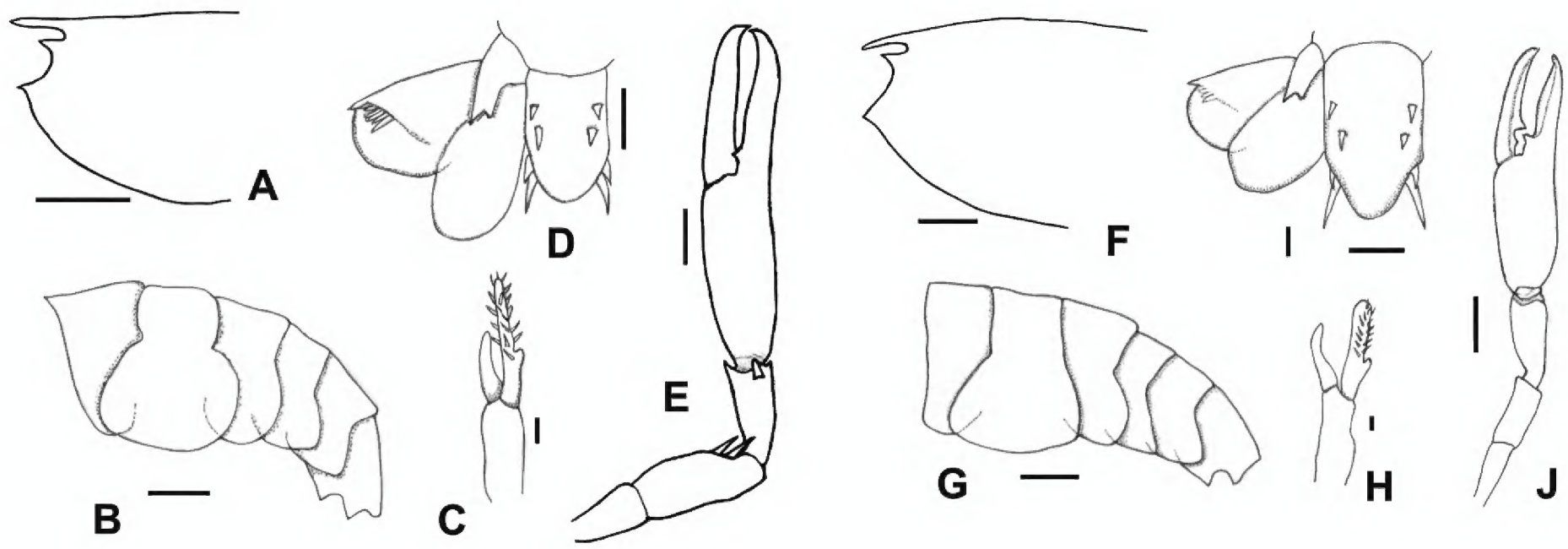

Figure 2. Schematic illustrations of *Eyryrhynchus burchelli* Calman, 1907. **A.** Rostrum and anterolateral portion of carapace, lateral view. **B.** Abdomen, lateral view. **C.** Second pleopod. **D.** Left uropods and telson. **E.** Second pereopod. Schematic illustrations of *Euryrhynchus wrzensiowski* Miers, 1877: **F.** Rostrum and anterolateral portion of carapace, lateral view. **G.** Abdomen, lateral view. **H.** Second pleopod. **I.** Left uropods and telson. **J.** Second pereopod. Scale bars: A, B, D–G, I, J = 5 mm; C, H = 2 mm.

Remarks. The morphology of our specimens agrees quite well with the description provided by Kensley and Walker (1982), García-Dávila and Magalhães (2003) and Melo (2003). No significative intraspecific variability was noticed.

***Euryrhynchus burchelli* Calman, 1907 (Figs 2A–E, 6)**

Identification characters (Fig. 2A–E). Rostrum triangular, depressed, unarmed, usually not reaching distal margin of cornea. Carapace smooth, antennal tooth present; abdomen smooth, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin convex, its posterolateral angles with 2 pair of spines, inner pair distinctly larger than outer one. P2 (second pair of chelipds) similar in shape, not in size; merus with 2 spines on inner margin, carpus with 1 subterminal, sharp spine on inner distal margin. Male Plp2 with endopod longer than exopod; endopod bearing 2 rows of setae on inner margin distally to reduced appendix interna.

Material examined. 36 spec. (INPA 2406), Caracaraí, vila Petrolina do Norte, Viruá National Park, [1°42′25″ N, 061°10′24″ W], 17–24-VII-2008, coll. J.D. do Vale; 1 male 1 ovig. female (INPA 2334), Caracaraí, igarapé Defrento, tributary of rio Anauá, 10°28′54.8136″ N, 061°14′11.5791″ W, 24-IX-2006, coll. L. H. Rapp Py-Daniel.

Distribution. Brazil (Amazonas, Amapá, Pará, Roraima [new record]) (see Pimentel and Magalhães 2014 for references; present study). The distribution in Roraima is shown in Figure 6.

Remarks. The morphology of our specimens agrees quite well with the description provided by Holthuis (1951) and Melo (2003). No significative intraspecific variability was noticed.

***Euryrhynchus wrzesniowskii* Miers, 1877**
(Fig. 2F–J, 7)

Identification characters (Fig. 2F–J). Rostrum triangular, depressed, unarmed, usually not reaching distal margin of cornea. Carapace smooth, antennal tooth present; abdomen smooth, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin convex, its posterolateral angles with 2 pair of spines, inner pair distinctly larger than outer one. P2 (second pair of chelipeds) similar in shape, not in size; both merus and carpus without subterminal spines on inner distal margin. Male Plp2 with endopod longer than exopod; endopod bearing 2 rows of setae on inner margin distally to reduced appendix interna.

Material examined. 10 males, 19 females (3 ovig.), 18 immat. spec. (INPA 2328), Bonfim, vicinal Tucano, unnamed igarapé, tributary of rio Tacutu, 03°25′25.3″ N, 060°03′44.1″ W, 26-II-20015, colls. M.A.L. Santos, I.R.S. Almeida, S.C. Emídio and F.C. Zanetti; 1 male, 3 females (INPA 2393), Bonfim, vicinal do Tucano, unnamed igarapé, tributary of rio Tacutu, 03°25′25.3″ N, 060°03′44.1″ W, 27-II-2015, colls. M.A.L. Santos, I.R.S. Almeida, S.C. Emídio and F.C. Zanetti; 1 female (INPA 2383), Boa Vista, Água Boa, sítio Marajoara, unnamed igarapé, 02°38′44.4″ N, 060°48′57.3″ W, 30-XI-2014, coll. M.A.L. Santos.

Distribution. Guyana, Suriname, French Guiana, Brazil (Amazonas, Pará, Roraima [new record]), (see Pimentel and Magalhães 2014 for references; present study). The distribution in Roraima is depicted in Figure 7.

Remarks. The morphology of our specimens agrees quite well with the description provided by Holthuis (1951) and Melo (2003). No significative intraspecific variability was noticed.

Palaemonidae Rafinesque, 1815
Genus *Macrobrachium* Spence Bate, 1868

***Macrobrachium amazonicum* (Heller, 1862)**
(Figs 3A–C, 8)

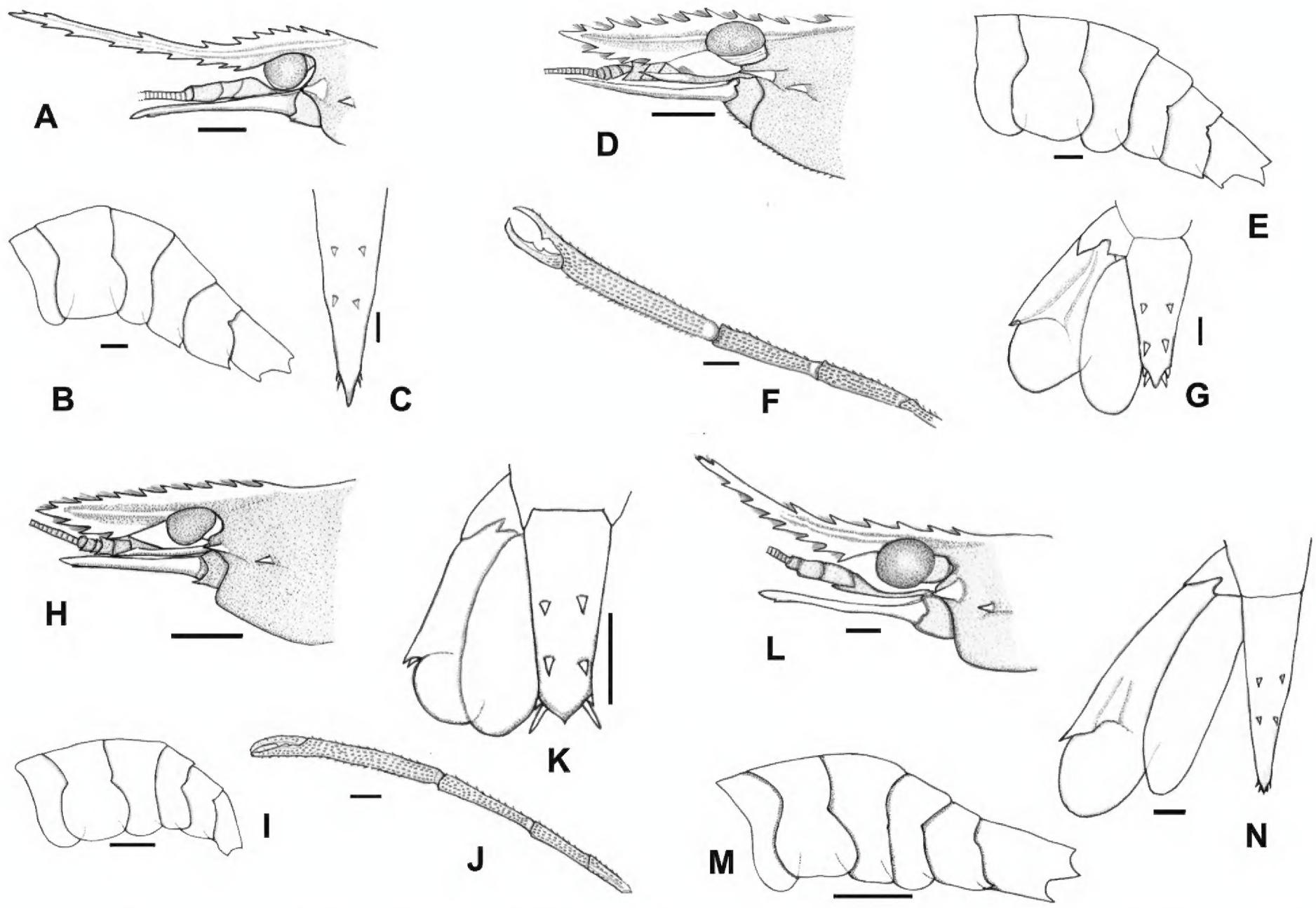

Figure 3. Schematic illustrations of *Macrobrachium amazonicum* (Heller, 1862). **A.** Rostrum and anterolateral portion of carapace, lateral view. **B.** Abdomen, lateral view. **C**. Telson. Schematic illustrations of *Macrobrachium brasiliense* (Heller, 1862): **D.** Rostrum and anterolateral portion of carapace, lateral view. **E.** Abdomen, lateral view. **F.** Second pereopod. **G.** Left uropods and telson. Schematic illustrations of *Macrobrachium ferreirai* Kensley & Walker, 1982: **H.** Rostrum and anterolateral portion of carapace, lateral view. **I.** Abdomen, lateral view. **J.** Second pereopod. **K.** Left uropods and telson. Schematic illustrations of *Macrobrachium jelskii* (Miers, 1877): **L.** Rostrum and anterolateral portion of carapace, lateral view. **M.** Abdomen, lateral view. **N.** Left uropods and telson. Scale bars: A, D, H–K, M = 10 mm; B, C, E–G, L, N = 5 mm.

Previous records. Pileggi et al. (2013).

Identification characters (Fig. 3A–C). Rostrum long, slender, sinuous, crested over the eyes, distal portion curved upwards, distinctly reaching beyond scaphocerite; rostral formula: 6–12(1 post-orbital tooth)/8–11. Carapace with antennal and hepatic teeth present, otherwise smooth; abdomen smooth, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson tapering, distally without distinct posterior margin, with 2 pair of posterolateral spines, inner pair distinctly larger than outer one, not overreaching (in adults) tip of telson.

Material examined. 6 males, 7 females (1 ovig.) (INPA 2341), Normandia, lago Caracaranã, [03°50′50.934″ N, 059°46′44.471″ W], tributary of rio Tacutu, 27-III-1992, colls. J. A.A. Gomes and J.S. Zuanon; 2 males, 1 ovig. female (INPA 2397), Amajarí, Maracá Ecological Station, igarapé Grande, rio Uraricoera, [03°27′ N, 061°41′ W], 24-III-2008, coll. unknown; 4 males (INPA 2321), Bonfim, igarapé Arraia, BR 174 road, 03°21’05″ N, 059°54’12″ W, tributary of rio Tacutu, 25-XI-1996, colls. V. Py-Daniel et al.; 1 male (INPA 2337), Bonfim, igarapé Surrão, [02°51′17.403″ N, 060°33′8.070″ W], tributary of rio Branco, 29-X-1987, colls. V. Py-Daniel et al.; 2 males (INPA 2338), Cantá, unnamed igarapé on BR 401 road, [02°47′36.589″ N, 060°38′26.33″ W], tributary of rio Branco, 25-III-1992, colls. J.A.A. Gomes, J. Zuanon, I. Sullivan and J. Albert; 4 males, 5 females (INPA 2340), Alto Alegre, igarapé Tupaquiri, [02°58′56.893″ N, 061°19′26.59″ W], tributary of rio Uraricoera, 24-X-1997, colls. V. Py-Daniel et al.; 9 spec. (2 ovig. females) (INPA 2379), Cantá, Vicinal I, fazenda Laçador, in a dammed stream, tributary of rio Branco, 02°07′18.3″ N, 060°50′57.5″ W, 25-V-2014, colls. M.G.S. Silva and F.P.L. Santos; 18 spec. (MIRR 317), Mucajai [02°26′57″ N, 060°55′16″ W], Apiaú region, vicinal 1, fazenda Cruviana, igarapé Arraia, tributary of rio Mucajai, 29-III-2010, colls. D.A. Lima and A.S. Sales; 1 ovig. female (INPA 2369), Caroebe, Entre Rios, rio Jatapú, 00°45′37.1″ N, 059°17′08.2″ W, 02-II-2015, colls. M.A.L. Santos, F.C. Zanetti, I.R.S. Almeida and S.C. Emídio.

Distribution. Venezuela, Colombia, Guyana, French Guiana, Brazil (Amazonas, Amapá, Acre, Ceará, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Pará, Pernambuco, Piauí, Rio Grande do Norte, Rio Grande do Sul, Roraima), Peru, Bolivia, Equador, Argentina, Paraguay (see Pimentel and Magalhães 2014 for references;

present study). The distribution in Roraima is depicted in Figure 8.

Remarks. The morphology of our specimens agrees quite well with the description provided by Holthuis (1952, 1966), García-Dávila and Magalhães (2003), and Melo (2003). In juveniles the inner pair of posterolateral spines can exceed the tip of telson, which still shows a rather distinct posterior margin.

Pileggi et al. (2013) listed this species from the municipality of Caracaraí, in the lower rio Branco region. The records presented here extend its distribution northwards as far as the rio Tacutu basin, in the northeastern part of the rio Branco basin (Fig. 8). The species also occurs in the rio Jatapu, a tributary of the rio Uatumã basin.

***Macrobrachium brasiliense* (Heller, 1862)**
(Figs 3D–G, 9)

Previous records. Castro and Silva (2013: as *M. inpa* in p. 41, and *M. brasiliense* in p. 42).

Identification characters (Fig. 3D–G). Rostrum straight, short, slightly directed downwards, reaching (or failing short of reaching) distal margin of scaphocerite; rostral formula: 8–13(1–3 post-orbital teeth)/2–5. Carapace with antennal and hepatic teeth present, anterolateral portion roughened by numerous spinules; abdomen also roughened by spinules, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin distinct, ending in a small acute point, usually overreached by inner pair of posterolateral spines. P2 (larger cheliped) similar in shape, unequal in size; larger cheliped overreaching scaphocerite with entire length of carpus, palm subcylindrical in cross-section, fingers a little less than half the length of palm, with row of tubercles on cutting edges.

Material examined. 1 male (INPA 2347), Amajarí, igarapé Tepequém, tributary of rio Amajarí, [03°41′28.13″ N, 061°42′05.22″ W], 24-II-2011, colls. A.A. Otaviano, F.C. Zanetti and A. Sales; 11 males (MIRR 274), Amajarí, unnamed igarapé, tributary of rio Amajarí, [03°38′41.80″ N, 061°41′38.16″ W, 24-IX-2010, colls. D. Teixeira and O. Grigio Jr.; 1 male, 8 females (1 ovig.) (MIRR 195), Amajarí, vila Bom Jesus, igarapé Coimbra, tributary of rio Trairão, 3°37′03.0″ N, 061°49′46.5″ W, 31-X-2009, colls. P.M. Castro and A.A. Otaviano; 6 males, 17 females (INPA 2396), Alto Alegre, rio Rainha do Inajá, cachoeira Macabei, tributary of rio Mucajai, [3°15′44.803″ N, 063°53′51.69″ W], 21-IV-1994, colls. V. Py-Daniel et al.; 1 male (MIRR 324), Boa Vista, Cachoeirinha, rio Cauamé, 02°52′ N, 060°44′ W, 31-I-2011, colls. P.M. Castro, F.C. Zanetti, A.A. Otaviano and D. Teixeira; 11 males, 30 females, 11 immat. spec. (INPA 2350), Boa Vista, urban area, praia Caçari, rio Cauamé, 02°52′ N, 060°39′ W, 31-I-2011, colls. P.M. Castro et al.; 3 males, 3 females, 1 immat. spec. (INPA 2349), Cantá, fazenda Rossi, igarapé Azul, tributary of rio Branco, [02°47′36.589″ N, 060°38′26.59″ W], 05-IV-2008, coll. F.A.G. Melo; 1 male (INPA 2401), Alto Alegre, serra dos Surucucus, Yanomami Indigenous Area, rio Mucajaí basin [02°47′ N, 063°40′ W], date unknown, colls. V. Py-Daniel et al.; 4 males, 6 females, 2 immat. spec. (INPA 2404), Boa Vista, farm 29 km from Boa Vista, unnamed igarapé, tributary of rio Branco, [02°46′08.53″ N, 060°39′22.63″ W], 29-III-1992, colls. J.A.A. Gomes, J. Zuanon, J. Sulivane and J. Albert; 1 male, 2 females (INPA 2387), Boa Vista, Água Boa, igarapé in sítio Marajoara, tributary of rio Branco, 02°38′44.4″N, 060°48′57.3″W, 30-XI-2014, coll. M.A.L. Santos; 1 male (INPA 2395), Cantá, igarapé Azul, tributary of rio Branco, BR 401 road, [02°36′34.93″ N, 060°36′12.09″ W], 29-X-1987, colls. V. Py-Daniel et al.; 5 males (INPA 2399), Alto Alegre, Xitei/Xidea (Yanomami indigenous village), Watatas, rio Parima, 02°36′24″ N, 063°52′17″ W, 11-IV-2002, colls. V. Py-Daniel et al.; 6 spec. (INPA 2400), Alto Alegre, Homoxi (Yanomami indigenous village), upper rio Mucajaí (Uxua-ú), tributary of rio Mucajaí, 02°29′ N, 063°43′ W, IV-2002, coll. W. Milliken; 6 males, 1 female, 1 immat. spec. (MIRR 211), Mucajai, Apiaú region, igarapé Perdido, tributary of rio Mucajai, [02°26′27.502″ N, 060°56′17.059″ W], 29-IX-2009, colls. D. A. Lima, C. R. Araújo, E. A. Barbosa, F. C. Zanetti and J.S. Tavares; 3 immat. males (MIRR 224), 2 spec. (MIRR 225), Mucajaí, Roxinho region, igarapé Mota, tributary of rio Mucajaí, [02°26′27.50″ N, 060°56′17.059″ W], 25-VIII-2009, coll. J.C. Tavares; 3 males, 4 females (MIRR 207), Mucajaí, Apiaú region, igarapé Perdido, tributary of rio Mucajaí, [02°26′27.50″ N, 060°56′17.059″ W], 19-IX-2009, coll. J. Tavares; 8 males, 5 females (MIRR 321), Mucajaí, Rufina region, sítio 3 Irmãos, igarapé Samaúma, tributary of rio Mucajaí, [02°26′27.50″ N, 060°56′17.059″ W], 05-XI-2006, colls. P. M. Castro et al.; 3 males (INPA 2374), Caracaraí, Terra Preta, igarapé Marixi, 02°21′17.7″ N, 060°25′9.4″ W, tributary of rio Xeriuini, 09-VI-2013, coll. F.C. Zanetti; 3 males, 9 females, 16 immat. spec. (INPA 2386), Cantá, Confiança I, vicinal II, igarapé Nicolau, tributary of rio Branco, 02°9′54.7″ N, 060°50′04.0″ W, 11-III-2014, colls. F.P.L. Santos and M.B. Santos; 6 males, 13 females, 11 immat. spec. (INPA 2375), São Luiz do Anauá, vicinal 21, igarapé Luizão, tributary of rio Anauá, 01°05′27.7″ N, 060°00′46.9″ W, 31-I-2015, colls. M.A.L Santos, F.C. Zanetti, S.C. Emídio, I.R.S. Almeida and B.C.A. Santos; 2 males, 3 females (INPA 2365), Rorainópolis, rio Anauá, 00°56.724′ N, 060°26.258′ W, 28-III-2015, coll. L.F.R. Guterres; 5 males, 14 females (2377), São João da Baliza, vicinal 28, igarapé near BR 210 road, tributary of rio Caroebe, 00°55′50.6″ N, 059°52′21.5″ W, 29-IV-2015, colls. M.A.L. Santos, F.C. Zanetti, P.M. Castro, S.C. Emídio and A.R. Lima; 3 males, 6 females, 4 immat. spec. (INPA 2361), Caroebe, vicinal 35, igarapé Taboca, tributary of rio Caroebe, 00°55′02.0″ N 059°43′41.3″ W, 03-II-2015, colls. F.C. Zanetti, I.R.S. Almeida, M.A.L. Santos and S.C. Emídio; 26 males, 30 females, 52 immat. spec. (INPA 2378), Caroebe, Entre Rios, igarapé Espanta Moleque, tributary of rio Jatapú, 00°54′02.8″ N, 059°25′52.9″ W, 02-II-2015, colls. M.A.L. Santos,

F.C. Zanetti, I.R.S. Almeida, S.C. Emídio and B.C.A. Santos; 2 females (INPA 2357), Caroebe, rio Caroebe, sítio Sumaúma, vicinal 5, 00°50′44.2″ N, 059°17′08.2″ W, 03-II-2015, colls. M.A.L. Santos, F.C. Zanetti, I.R.S. Almeida and S.C. Emídio; 2 males (INPA 2354), Caroebe, Entre Rios, rio Jatapu, 00°45′37.1″ N, 059°17′08.2″ W, 2-II-2015, colls. M.A.L. Santos, F.C. Zanetti, I. R.S. Almeida and S.C. Emídio; 1 male, 7 females (INPA 2364), São Luiz do Anauá, fazenda Água Limpa, rio dos Peixes, tributary of rio Jauaperí, 00°41′11.5″ N, 060°11′17.4″ W, 5-XII-2015; colls. M.A.L. Santos and F.K.A. Santos; 3 males (INPA 2392), Rorainópolis, vila Colina, igarapé on vicinal 20, tributary of rio Jauaperi, 00°37′16.7″ N, 060°29′53.9″ W, 21-XII-2014, colls. M.A.L. Santos, B.C.A. Santos and N.L. Ferreira; 29 males, 14 females (INPA 2362), Rorainópolis, Vila Colina, BR 174 road, rio Jauaperi, 00°30′51.2″ N, 060°27′54.9″ W, 29-IV-2015, colls. M.A.L. Santos, F.C. Zanetti, P.M. Castro, S.C. Emídio and A.R. Lima; 1 male, 1 female (INPA 2331), Caracaraí, igarapé Defrento, tributary of rio Anauá, 00°00′02″ N, 061°29′19″ W, 24-IX-2006, coll. L. Rapp Py-Daniel; 5 males, 6 females, 9 immat. spec. (MIRR 322), 5 spec. (MIRR 275), 14 spec. (MIRR 251), Caracaraí, Caicubi, igarapé Tubana, tributary of rio Jufari, [01°17′09.35″ S, 061°55′57.40″ W], 06-IX-2011, colls. P.M. Castro and A.A. Otaviano.

Distribution. Venezuela, Guyana, Suriname, French Guiana, Brazil (Amazonas, Amapá, Bahia, Maranhão, Mato Grosso, Pará, Paraná, Roraima, São Paulo), Colombia, Peru, Ecuador (see Pimentel and Magalhães 2014 for references; this study). The distribution in Roraima is depicted in Figure 9.

Remarks. The morphology of our specimens agrees quite well with the description provided by Holthuis (1952), García-Dávila and Magalhães (2003), and Melo (2003).

Macrobrachium brasiliense was first recorded in Roraima by Castro and Silva (2013) from the municipality of Mucajaí, and some of their specimens were misidentified as *M. inpa*. The records presented here show that the species is widely distributed in the state of Roraima (Fig. 9).

Macrobrachium ferreirai Kensley & Walker, 1982 (Figs 3H–K, 8)

Previous records. Melo (2003, in list and map).

Identification characters (Fig. 3H–K). Rostrum straight, short, slightly directed downwards, reaching (or failing short of reaching) distal margin of scaphocerite; rostral formula: 9–10(2–3 post-orbital teeth)/1–2. Carapace with antennal and hepatic teeth present, anterolateral portion smooth; abdomen smooth, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin distinct, ending in a small acute point, usually overreached by inner pair of posterolateral spines. P2 (larger cheliped) similar in shape, slightly unequal in size, larger than entire body in full grown adults; palm subcylindrical in cross-section, fingers a little less than half the length of palm, cutting edges without tubercles.

Material examined. 3 spec. (INPA 2332), Caracaraí, igarapé Corredeira, tributary of igarapé Leite, tributary of lago Aliança, lower rio Branco basin, 01°28′55″ N, 061°14′12″ W, 29-IX-2006, coll. L.H. Rapp Py-Daniel.

Distribution. Colombia, Brazil (Amazonas, Mato Grosso, Rondônia, Roraima) (see Pileggi et al. 2013 for references; present study). The distribution in Roraima is depicted in Figure 8.

Remarks. The morphology of our few specimens agrees very well with the description provided by Kensley and Walker (1992). *Macrobrachium ferreirai* closely resembles *M. brasiliense* and their juveniles and subadult specimens are almost impossible to distinguish. Adult specimens can be identified by the morphology of the second pair of chelipeds, especially the spinulation (fewer and longer spinules in *M. brasiliense*; denser and smaller in *M. ferreirai*) and the presence (in *M. brasiliense*) or absence (in *M. ferreirai*) of tubercles in the cutting edges of the fingers.

Ramos-Porto and Coelho (1998) and Melo (2003) listed *M. ferreirai* as occurring in the state of Roraima, but did not specify the localities or document the record with voucher specimens. Pileggi et al. (2013) discussed that the occurrence of the species in the state was probable since *M. ferreirai* is present in the Negro River basin and the Branco River is its main tributary. The records presented here confirm its occurrence in Roraima (Fig. 8).

Macrobrachium jelskii (Miers, 1877) (Figs 3L–N, 8)

Previous records. Cavalcante and Castro (2014).

Identification characters (Fig. 3L–N). Rostrum long, slender, straight over the eyes, distal portion curved upwards, reaching a little beyond the scaphocerite; rostral formula: 7–10(1 post-orbital tooth)/5–7. Carapace with antennal and hepatic teeth present, otherwise smooth; abdomen smooth, pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin distinct, ending in a small acute point, overreached by inner pair of posterolateral spines. P2 (larger cheliped) similar in shape and size.

Material examined. 1 male (INPA 2384), Boa Vista, rio Cauamé, 02°51′00.7″ N, 060°37′49.7″ W, 04-XII-2014, colls. M.A.L. Santos and I.R.S. Almeida; 3 females, 6 immat. spec. (INPA 2348), Cantá, unnamed igarapé, tributary of rio Branco, 02°43′15.5″ N, 060°37′48.9″ W, 15-XII-2006, coll. F.A.G. Melo; 4 males, 45 females (4 ovig.) (INPA 2327), Mucajaí, Tamandaré, rio Mucajaí, 02°33′48.2″ N, 060°55′43.8″ W, 12-II-2015, colls. F.C. Zanetti and S.C. Emídio.

Distribution. Trinidad, Venezuela, Guyana, Suriname, French Guiana, Brazil (Acre, Amazonas, Amapá, Alagoas, Bahia, Ceará, Espírito Santo, Maranhão, Mato Grosso, Minas Gerais, Pará, Paraíba, Paraná, Pernam-

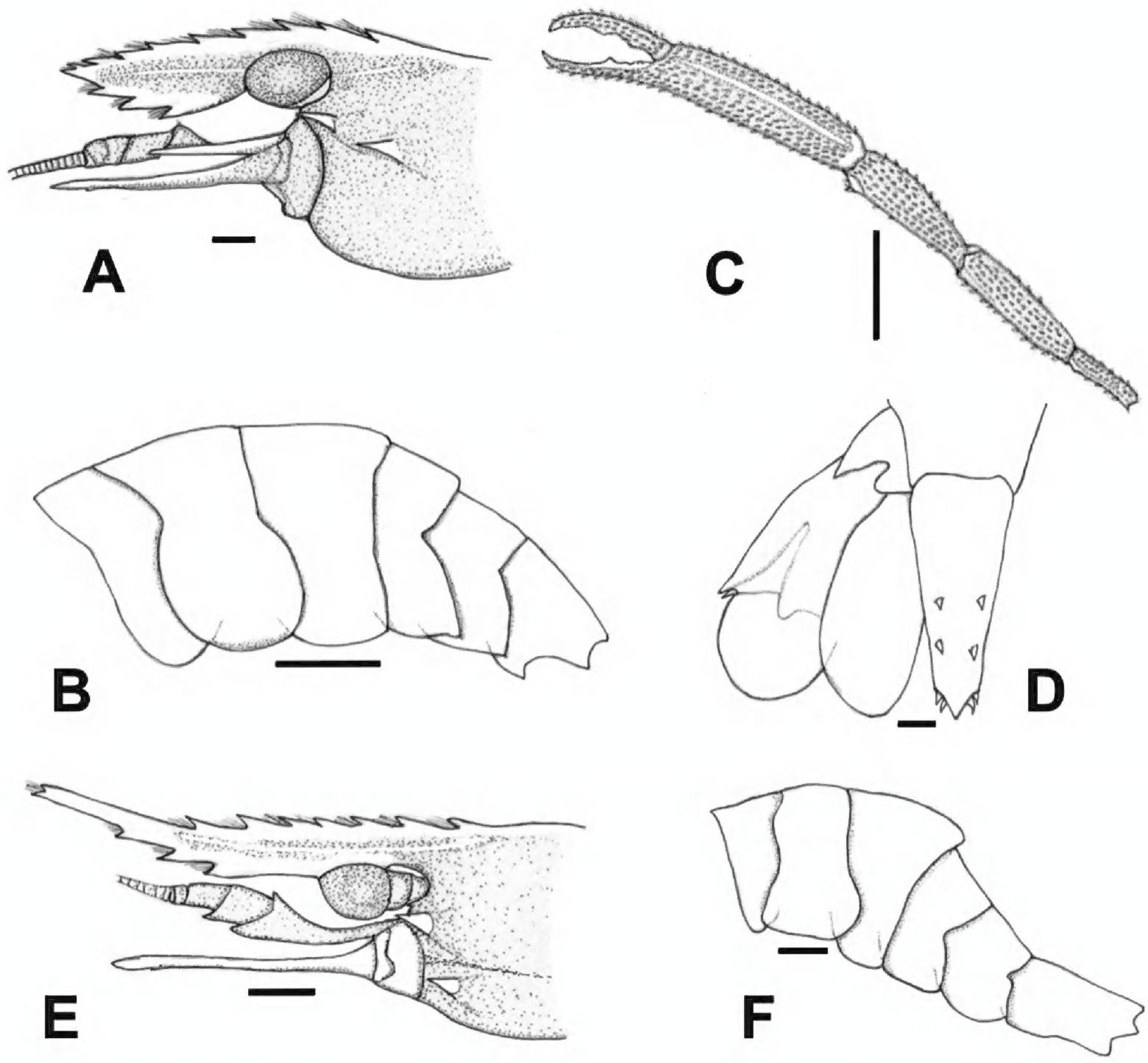

Figure 4. Schematic illustrations of *Macrobrachium nattereri* (Heller, 1862). **A.** Rostrum and anterolateral portion of carapace, lateral view. **B.** Abdomen, lateral view. **C.** Second pereopod**. D.** Left uropods and telson. Schematic illustrations of *Palaemon yuna* Carvalho, Magalhães & Mantelatto, 2014: **E.** Rostrum and anterolateral portion of carapace, lateral view. **F**. Abdomen, lateral view. Scale bars: A, D–F = 5 mm; B, C = 10 mm.

buco, Rio de Janeiro, Rio Grande do Norte, Roraima, São Paulo, Sergipe), Peru, Bolivia, Argentina (Cavalcante and Castro 2014; see Vera-Silva et al. 2017 for references; present study). The distribution in Roraima is depicted in Figure 8.

Remarks. The morphology of our specimens agrees very well with the description provided by Holthuis (1952), García-Dávila and Magalhães (2003), and Melo (2003). Adult specimens of *M. jelskii* and *M. amazonicum* can be easily distinguished by the shape of the rostrum and telson, although juveniles and subadults are somewhat difficult to separate. Vera-Silva et al. (2017) presented a set of characters to differentiate both species.

***Macrobrachium nattereri* (Heller, 1862)**
(Figs 4A–D, 10)

Previous records. Ramos-Porto and Coelho (1998, in list); Melo (2003, in list); Castro and Silva (2013).

Identification characters (Fig. 4A–D). Rostrum straight, short, slightly directed downwards, reaching distal margin of scaphocerite; rostral formula: 8–11(2–3 post-orbital teeth)/1–4. Carapace with antennal and hepatic spines present, anterolateral portion roughened by numerous spinules; abdomen also roughened by spinules, pleurae of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin distinct, ending in a small acute point, usually overreached by inner pair of posterolateral spines. P2 (larger cheliped) similar in shape, unequal in size; larger cheliped overreaching scaphocerite with large part of the length of carpus, palm pear-shaped in cross-section with distinct longitudinal sulcus on outer surface, fingers approximately 0.6 times the length of palm, with row of tubercles on cutting edges.

Material examined. 3 males (INPA 2329), Pacaraima, igarapé Miang, tributary of rio Surumu, 04°29′02.11″ N, 061°07′51.0″ W, 13-VI-2014, colls. M.A.L. Santos, F.C. Zanetti and S.C. Emídio; 76 spec. (INPA 2371), Pacaraima, igarapé Miang, tributary of rio Surumu, 04°29′02.11″ N, 061°07′51.0″ W, 10-III-2014, colls. R.E. Farias and F.R. Silva; 16 spec. (INPA 2380), Pacaraima, igarapé Miang, tributary of rio Surumu, 04°29′02.11″ N, 061°07′51.0″ W, 24-I-2015, colls. F.C. Zanetti and S.C. Emídio; 4 males, 1 female (INPA 2343), Pacaraima, BR 174 road, Campinho, igarapé Ávila, 04°26′41.9″ N,

061°07′31.1″ W, 27-X-1987, colls. V. Py-Daniel et al.; 2 males, 2 females (INPA 2394), Amajari, igarapé Coimbra, tributary of rio Trairão, vicinal Bom Jesus, 03°37′03.0″ N, 061°49′46.5″ W, 18-IV-2015, colls. F.C. Zanetti, M.A.L. Santos and J. Santos; 1 female (INPA 2373), Bonfim, rio Tacutu, 03°21′14.8″ N, 059°49′57.4″ W, 07-IV-2015, colls. F. C. Zanetti and S.C. Emídio; 1 male (INPA 2339), Iracema, Hakoma, rio Tissipora-ú, tributary of rio Mucajaí, [02°57′14.47″ N 061°35′31.66″ W], 23-VIII-1983, colls. V. Py-Daniel et al.; 1 female, 4 immat. spec. (MIRR 64), Boa Vista, unnamed igarapé, tributary of rio Cauamé, 02°52′51.90″ N, 060°40′41.81″ W, 07-X-2010, colls. A.A. Otaviano, R. Serafim, F.C. Zanetti and D.A. Texeira; 3 males, 9 females (1 ovig.) (INPA 2398), Alto Alegre, Xitei/Xidea, rio Parima, 02°36′24″ N ,063°52′17″ W, 20-VIII-1993, colls. V. Py-Daniel et al.; 6 males, 2 females (INPA 2355), Cantá, igarapé near Serra Grande I, tributary of rio Branco, 02°33′27.9″ N, 060°44′53.9″ W, 08-XII-2007, colls. F.A.G. Melo, D. Maciel, J.C.P. Mota and D. Silva; 5 males (INPA 2342), Alto Alegre, Homoxi, upper rio Mucajaí (Uxua-ú), tributary of rio Mucajaí, 02°29′51″ N, 063°43′47″ W, 25-VIII-1991, colls. V. Py-Daniel et al.; 14 males, 3 females (INPA 2351), Mucajaí, Apiaú region, igarapé Perdido, tributary of rio Mucajaí, [02°26′27.502″ N, 060°56′17.059″ W], 19-IX-2009, colls. D.A. Lima, E.A. Barbosa, C.R. Araújo, F.C. Zanetti and J.S. Tavares; 9 males, 1 female (INPA 2391), São João da Baliza, vicinal 26, tributary of rio Jauaperi, 00°40′ N, 060°03′ W, 28-IV-2015, colls. M.A.L. Santos, F.C. Zanetti, P.M. Castro, S.C. Emídio and A.R. Lima.

Distribution. Venezuela, Colombia, French Guiana, Brazil (Amazonas, Amapá, Bahia, Ceará, Pará, Roraima), Peru (see Pimentel and Magalhães 2014 for references; present study). The distribution in Roraima is depicted in Figure 10.

Remarks. The morphology of our specimens agrees very well with the description provided by Holthuis (1952). *Macrobrachium nattereri* closely resembles *M. brasiliense* and *M. ferreirai*, and their juveniles and subadult specimens are very difficult to distinguish (Kensley and Walker 1992).

Ramos-Porto and Coelho (1998) and Melo (2003) listed *M. nattereri* as occurring in the state of Roraima, but without specifying the localities. The records presented here confirm its occurrence in Roraima (Fig. 10).

Genus *Palaemon* Weber, 1795

Palaemon yuna Carvalho, Magalhães & Mantelatto, 2014 (Figs 4E, F, 11)

Identification characters (Fig. 4E, F). Rostrum slender, slightly curved upwards distally, overreaching distal margin of scaphocerite; rostral formula: 6–10(1 post-orbital tooth)/2–5. First antennular segment with projection of its anterolateral margin reaching the distal margin of second segment; anterolateral spine of first antennular segment not overreaching one third of the projection of the anterolateral margin. Carapace smooth, with antennal and branchiostegal teeth present, branchiostegal suture situated between both teeth; abdomen with pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin distinct, ending in a small acute point, overreached by inner pair of posterolateral spines. P2 similar in shape and size, overreaching scaphocerite with approximately half of the distal part of carpus.

Material examined. 1 male, 1 female (MIRR 83), Boa Vista, BR 174 road between Boa Vista and Mucajaí, 02°46′08.53″ N, 060°39′22.63″ W, 28-II-2007, colls. L.F.R. Guterres, P.M. Castro and J.C.P. Mota; 2 spec. (INPA 2408), Caracaraí, Parque Nacional do Viruá [01°48′51.28″ N, 061°08′04.18″ W], 13-VII-2008, coll. J.D. do Vale; 2 males (MIRR 2385), Caracaraí, Terra Preta, igarapé Marixi, tributary of rio Xeriuini, tributary of rio Branco, 00°50′52.916″ N, 061°57′51.778″ W, 09-VI-2013, coll. F.C. Zanetti; 1 male (INPA 2352), Rorainópolis, igarapé on vicinal 20, tributary of rio Jauaperi, Colinas, 00°37′16.7″ N, 060°29′53.9″ W, 21-XII-2014, colls. M.A.L. Santos, B.C.A. Santos and N.L. Ferreira; 1 male, 2 females (INPA 2326), Caracaraí, Terra Preta, rio Xeriuni, 00°33′54.731″ N, 061°57′9.945″ W, 25-III-2014, colls. M.A.L. Santos e F.C. Zanetti; 1 female (INPA 2303), Caracaraí, Caicubí, igarapé Caicubi, tributary of rio Branco, 01°0′52.221″ S, 62°6′15.601″ W, 06-IX-2011, colls. P.M. Castro and A.A. Otaviano.

Distribution. Brazil (Amazonas, Roraima [new record]) (Carvalho et al. 2014; this study). The distribution in Roraima is depicted in Figure 11.

Remarks. The morphology of our specimens agrees with the description provided by Carvalho et al. (2014).

Until recently, *Palaemon carteri* (Gordon, 1935) was considered to be distributed in the Negro River basin (Magalhães and Pereira 2007). However, in a study on the morphological and molecular differentiation of two species of *Palaemon* from the Amazon basin, Carvalho et al. (2014) concluded that the populations distributed in the Negro River basin were distinct and described a new species, *Palaemon yuna*, from this basin. The records presented herein indicate that the distribution of this species also encompasses the Branco River basin.

Genus *Pseudopalaemon* Sollaud, 1911

Pseudopalaemon chryseus Kensley & Walker, 1982 (Figs 5A–C, 12)

Identification characters (Fig. 5A–C). Rostrum straight, very slightly curved upwards distally, overreaching distal margin of scaphocerite; rostral formula: 8–10(1–2 post-orbital teeth)/3–7. Carapace smooth, with antennal and hepatic teeth present, branchiostegal suture indistinct; abdomen smooth, with pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin triangular, ending in a distinct

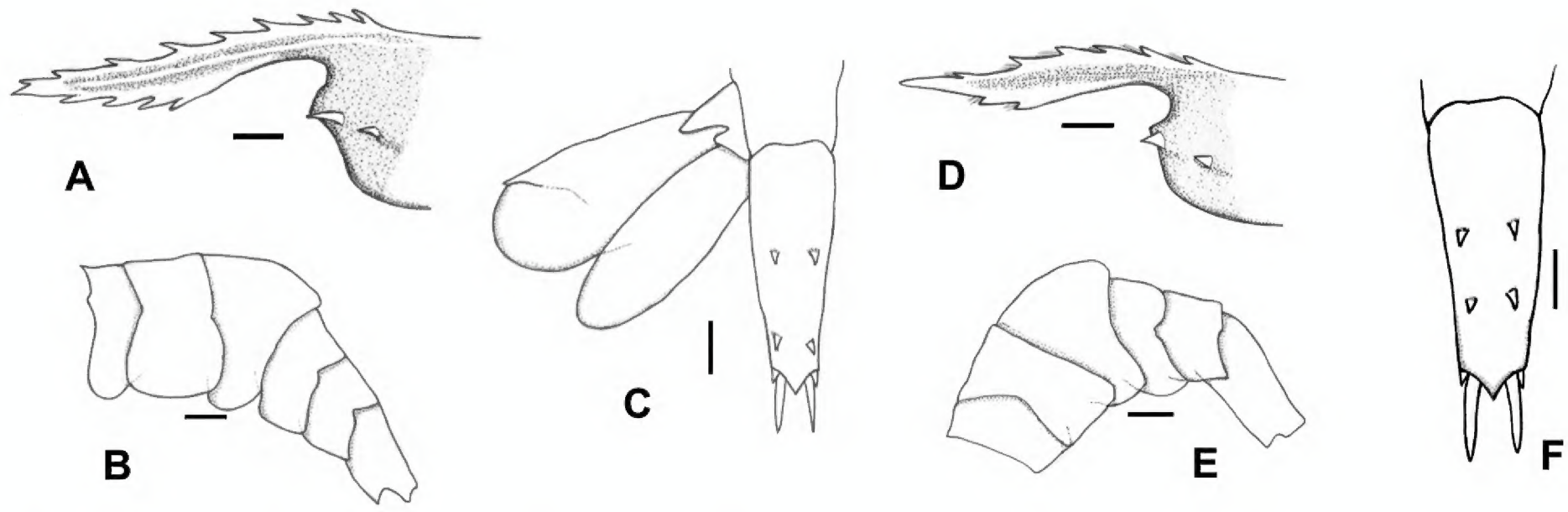

Figure 5. Schematic illustrations of *Pseudopalaemon chryseus* Kensley & Walker, 1982. **A**. Rostrum and anterolateral portion of carapace, lateral view. **B.** Abdomen, lateral view. **C.** Left uropods and telson. Schematic illustrations of *Pseudopalaemon gouldingi* Kensley & Walker, 1982: **D.** Rostrum and anterolateral portion of carapace, lateral view. **E.** Abdomen, lateral view. **F.** Telson. Scale bars: A–F = 5 mm.

acute point, clearly overreached by inner pair of posterolateral spines. P2 similar in shape and size, chela as long as carpus.

Material examined. 21 males, 30 females (6 ovig.), 24 immat. spec. (INPA 2353), Bonfim, vicinal do Tucano, unnamed igarapé, tributary of rio Tacutu, 03°33′48.2″ N, 060°55′43.8″ W, 27-II-2015, colls. M.A.L. Santos, I.R.S. Almeida, S.C. Emídio and F.C. Zanetti; 49 males, 110 females (1 ovig.), 270 immat. spec. (INPA 2376), Bonfim, vicinal Tucano, unnamed igarapé, tributary of rio Tacutu, 03°25′25.3″ N, 060°3′44.1″ W, 26-II-2015, colls. M.A.L. Santos, I.R.S. Almeida, S.C. Emídio and F.C. Zanetti; 5 males, 6 females, 9 immat. spec. (INPA 2358), Alto Alegre, Taiano region, unnamed igarapé, tributary of Uraricoera, 03°24′45.0″ N, 061°09′28.8″ W, 13-II-2015, colls. M.A.L. Santos, I.R.S. Almeida and M.C.A. Santos; 6 spec. (INPA 2410), Bonfim, BR 401 road, km 113, igarapé Arraia, tributary of rio Tacutu [03°21′5″ N, 059°54′12″ W], 29-X-1987, coll. V. Py-Daniel; 21 males, 21 females (7 ovig.), 8 immat. spec. (INPA 2356), Boa Vista, on ponds along BR 174 road, rio Uraricoera basin, 03°18′19.5″ N, 060°51′31.6″ W, 08-II-2015, colls. M.A.L. Santos and I.R.S. Almeida; 3 males, 4 females (INPA 2367), Boa Vista, unnamed igarapé, tributary of rio Uraricoera, 03°18′17.2″ N, 060°51′25.1″ W, 08-IX-2014, colls. M.A.L. Santos, I.R.S Almeida and M.C.A. Santos; 2 males, 11 females (1 ovig.) 8 immat. spec. (INPA 2366), Bonfim, Tucano region, igarapé Serra, tributary of rio Tacutu, 03°13′57.0″ N, 060°08′13.2″ W, 27-II-2015, colls. M.A.L. Santos and F.C Zanetti; 90 males, 244 females (49 ovig.) 640 immat. spec. (INPA 2381), Bonfim, sítio Viana, unnamed igarapé on vicinal Caju, tributary of rio Tacutu, 03°4′37″ N, 060°16′20″ W, 27-II-2015, colls. M.A.L. Santos, F.C. Zanetti, S.C. Emídio and I.R.S. Almeida; 1 male, 5 female (1 ovig.) (INPA 2370), Alto Alegre, unnamed igarapé, tributary of rio Cauamé, 02°57′30.6″ N, 061°4′45.8″ W, 31-X-2014, colls. M.A.L. Santos, I.R.S. Almeida, M.C.A. Santos and P.L.J. Lopes; 1 male, 16 females, 25 immat. spec. (INPA 2390), Cantá, sítio Senhorinha, unnamed igarapé, tributary of rio Branco, 02°57′29.0″ N, 060°32′54.2″ W, 18-I-2015, coll. M.A.L. Santos; 3 males, 1 immat. spec. (INPA 2336), Alto Alegre, igarapé Xiquibá, tributary of rio Uraricoera, 02°57′14.47″ N, 061°35′31.66″ W, 24-X-1987, colls. V. Py-Daniel et al.; 4 females (INPA 2345), Boa Vista, rio Cauamé, praia da Polar, 02°52′ N, 060°40′ W, 18-IV-2013, colls. C.C.O. Coelho, F.C. Zanetti, A.A. Otaviano and J. Gomes; 15 spec. (INPA 2409), Boa Vista, rio Cauamé, praia Polar, 02°52′ N, 060°40′ W, 08-X-2010, colls. A.A. Otaviano, F.C. Zanetti, D.A. Texeira and R. Serafim; 38 males, 3 females, 7 immat. spec. (INPA 2335), Cantá, fazenda Santa Cecília, tributary of rio Branco, 02°48′24.2″ N, 060°37′09.0″ W, 23-III-1992, colls. J. Zuanon and A.A. Gomes; 2 spec. (INPA 2402), Cantá, igarapé Inácio, tributary of rio Branco, 02°45′12.88″ N, 060°34′17.04″ W, 18-X-2013, colls. N.P. Queiroz, L.F.P. Queiroz and M.A.L. Santos; 1 male, 6 females (1 ovig.) (INPA 2389), Cantá, Serra Grande 1 road, igarapé Fuquia, tributary of rio Branco, 02°42′25″ N, 060°40′31″ W, 27-XI-2014, colls. M.A.L. Santos, I.R.S. Almeida and M.C.A. Santos; 8 males, 31 females, 12 immat. spec. (INPA 2388), Boa Vista, sítio Honoroato, Água Boa, unnamed igarapé, tributary of rio Branco, 02°38′44.4″ N, 060°48′57.3″ W, 30-XI-2014, coll. M.A.L. Santos; 48 males, 9 females (1 ovig.) (INPA 2323), Boa Vista, unnamed igarapé on BR 174 road to Pacaraima, tributary of rio Uraricoera, 02°9′46.9″ N, 060°49′52.5″ W, 29-VII-2014, colls. M.A.L. Santos, F.C. Zanetti, I.R.S. Almeida and M.C.A. Santos; 8 spec. (INPA 2407), Caracaraí, Viruá National Park, unnamed igarapé, tributary of rio Branco, [01°48′51.28″ N, 061°08′04.18″ W], 15–16-VII-2008, coll. J.D. do Vale; 1 female (INPA 2333), Caracaraí, rio Branco, [01°48′51.28″ N, 061°08′04.18″ W], 28-IX-2006, coll. L.H. Rapp Py--Daniel; 5 males, 4 immat. spec. (MIRR 80), Caracaraí, igarapé Bueiro, Perdida road, 01°25′16.8″N, 060°59′7.7″ W, date unknown, colls. P.M. Castro, C.R. Dias and J.C.P. Mota; 10 spec. (INPA 2344), Caracarai, Caicubi, rio Jufari, 01°17′09.35″ S, 061°55′57.40″ W, 11-VI-2013, coll. F.C. Zanetti; 1 male, 2 ovig. females (INPA 2346), Caracaraí, Terra Preta, igarapé Marixi, tributary of rio

Xeriuni, 00°51′52.916″ N, 061°57′51.778″ W, 09-VI-2013, coll. F.C. Zanetti; 22 males, 14 females, 45 immat. spec. (INPA 2372), Rorainópolis, vicinal 20, vila Colina, igarapé Igília Saco, tributary of rio Jauaperí, 00°37′17.0″ N, 060°33′22.5″ W, 21-XII-2014, colls. M.A.L. Santos, B.C.A. Santos and N.L. Ferreira; 3 males, 17 females, 49 immat. spec. (INPA 2363), Rorainópolis, vila Colina, unnamed igarapé on vicinal 20, tributary of rio Jauaperí, 00°37′16.7″ N, 060°29′53.9″ W, 21-XII-2014, colls. M.A.L. Santos, B.C.A. Santos and N.L. Ferreira.

Distribution. Colombia, Brazil (Amazonas, Amapá, Pará, Roraima [new record]) (see Pimentel and Magalhães 2014 for references; this study). The distribution in Roraima is depicted in Figure 12.

Remarks. The morphology of our specimens agrees with the description provided by Kensley and Walker (1992) and Melo (2003).

Pseudopalaemon gouldingi Kensley & Walker, 1982 (Figs 5D–F, 11)

Identification characters (Fig. 5D–F). Rostrum short, arched over the eyes, as long as distal margin of scaphocerite; rostral formula: 8–13(2–3 post-orbital teeth)/1–3. Carapace smooth, with antennal and hepatic teeth present, branchiostegal suture indistinct; abdomen smooth, with pleura of second somite enlarged and overlapping pleuron of first and third somites. Telson with posterior margin triangular, ending in a distinct acute point, clearly overreached by inner pair of posterolateral spines. P2 similar in shape and size, chela as long as carpus.

Material examined. 11 females, 1 immat. spec. (INPA 2320), Bonfim, BR 401 road, igarapé Arraia, tributary of rio Tacutu, 03°21′05″ N, 059°54′12″ W, 25-XI-1996, colls. V. Py-Daniel et al.

Distribution. Brazil (Amazonas, Roraima [new record]) (Kensley and Walker, 1982; present study). The distribution in Roraima is depicted in Figure 11.

Remarks. In general, the morphology of our specimens agrees well the description provided by Kensley and Walker (1992). However, the curvature of the rostrum over the eyes (Fig. 5D) seems to be a little less pronounced in the specimens from Roraima than those from the Negro River basin (see Kensley and Walker 1982: 18, fig. 20)

Discussion

With a total of 12 species documented herein from the Branco River drainage system, the basin exhibits the highest species richness among the sub-basins of the Amazon River where inventory is available. The number of species in the Branco River basin is higher than the number documented for the Uatumã River basin (8 spp.), Trombetas River basin (7 spp.), Pastaza River basin (6 spp.) (Magalhães 2005, Magalhães and Pereira 2007), and the Xingu River basin (11 spp.; C. Magalhães et al., unpubl. data); it is only smaller than that verified for the Negro River basin (16 species) by Magalhães and Pereira (2007). The richness found in the Branco River basin is 75% similar to that verified for the Negro River basin. With the exception of *E. wrzesniowskii*, all species herein listed from the Branco River basin were also listed from the Negro River basin, considering that the record of *Palaemonetes carteri* in Magalhães and Pereira (2007) currently refers to *P. yuna* (see Carvalho et al. 2014).

Acetes paraguayensis was found in the Jauaperi River, a left bank tributary of the lower Branco River (Fig. 1). The occurrence of 3 species of *Euryrhynchus* in Roraima was somewhat expected due to their distribution

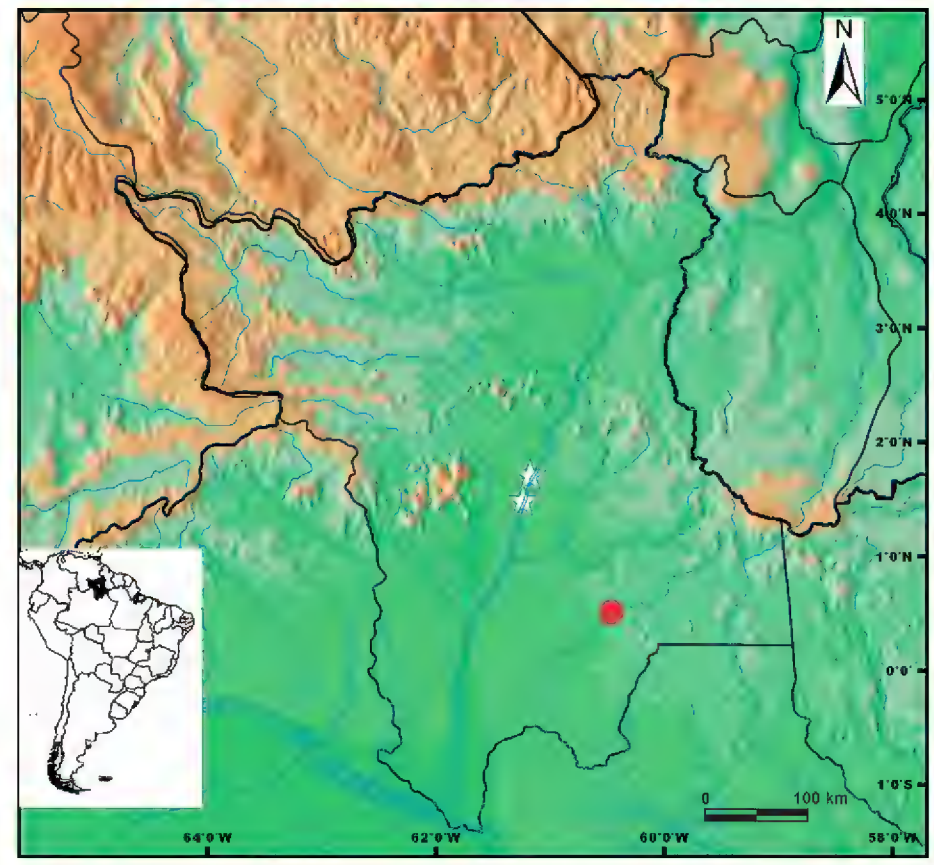

Figure 6. Map showing the distribution of the records of *Acetes paraguayensis* Hansen, 1919 (circle) and *Eyryrhynchus burchelli* Calman, 1907 (star) in the state of Roraima, Brazil. Some symbols may represent more than one record.

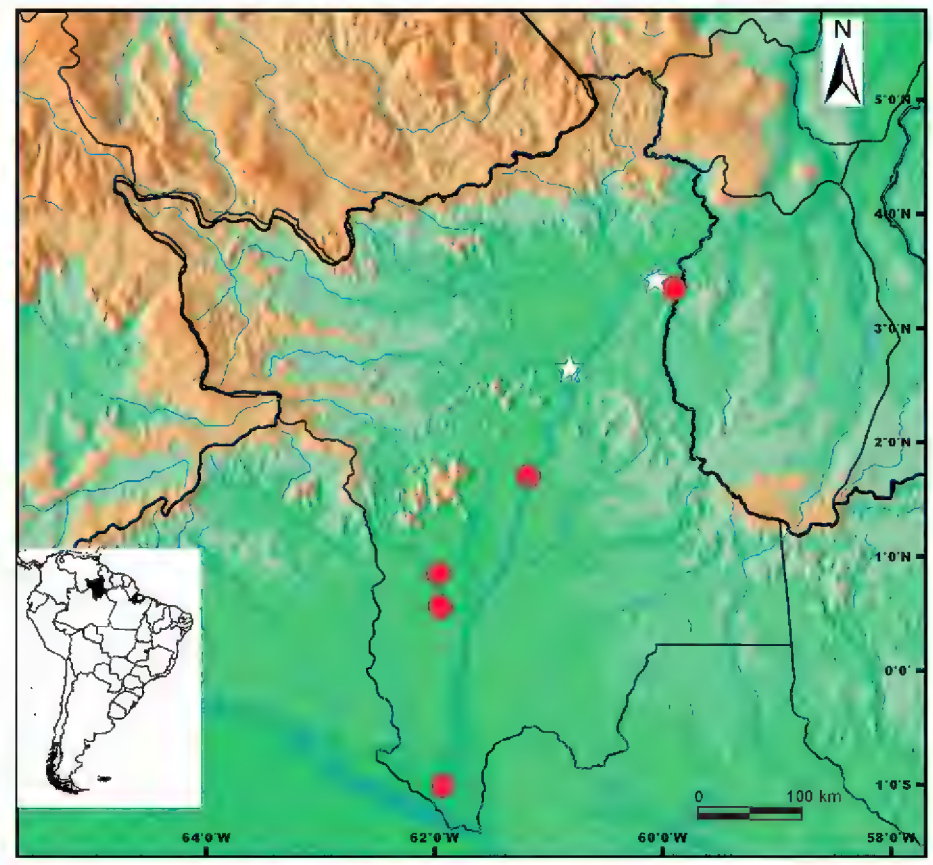

Figure 7. Map showing the distribution of the records of *Eyryrhynchus amazoniensis* Tiefenbacher, 1978 (circle) and *E. wrzensiowski* Miers, 1877 (star) in the state of Roraima, Brazil. Some symbols may represent more than one record.

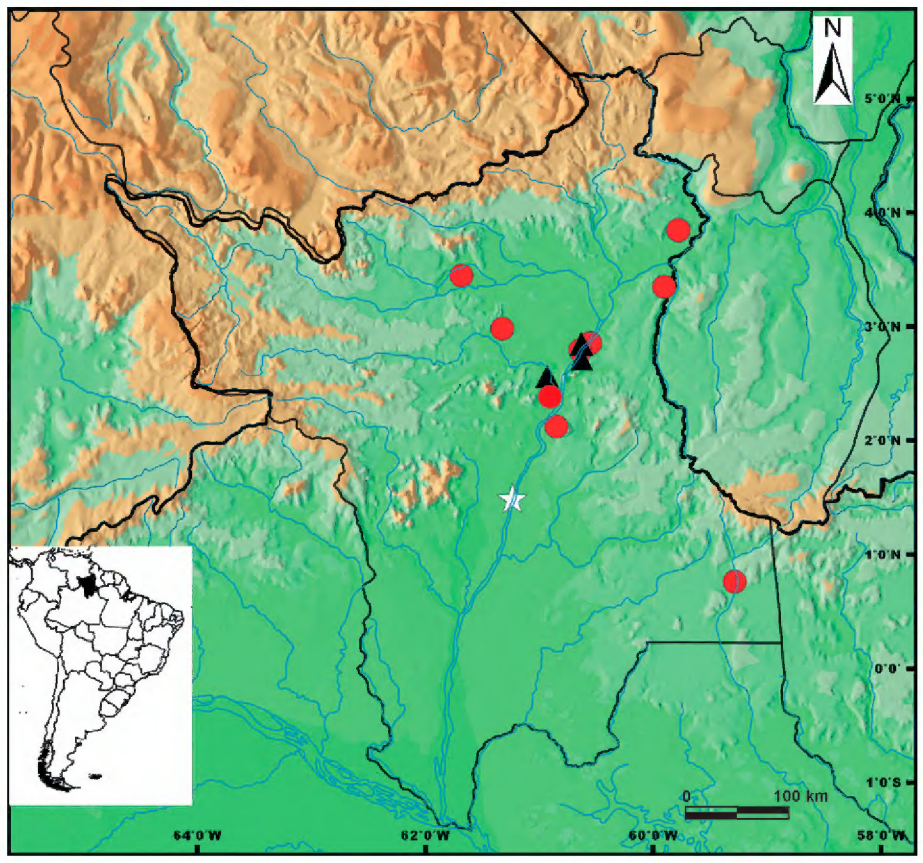

Figure 8. Map showing the distribution of the records of *Macrobrachium amazonicum* (Heller, 1862) (circle), *M. ferreirai* Kensley & Walker, 1982 (star) and *M. jelskii* (Miers, 1877) (triangle) in the state of Roraima, Brazil. Some symbols may represent more than one record.

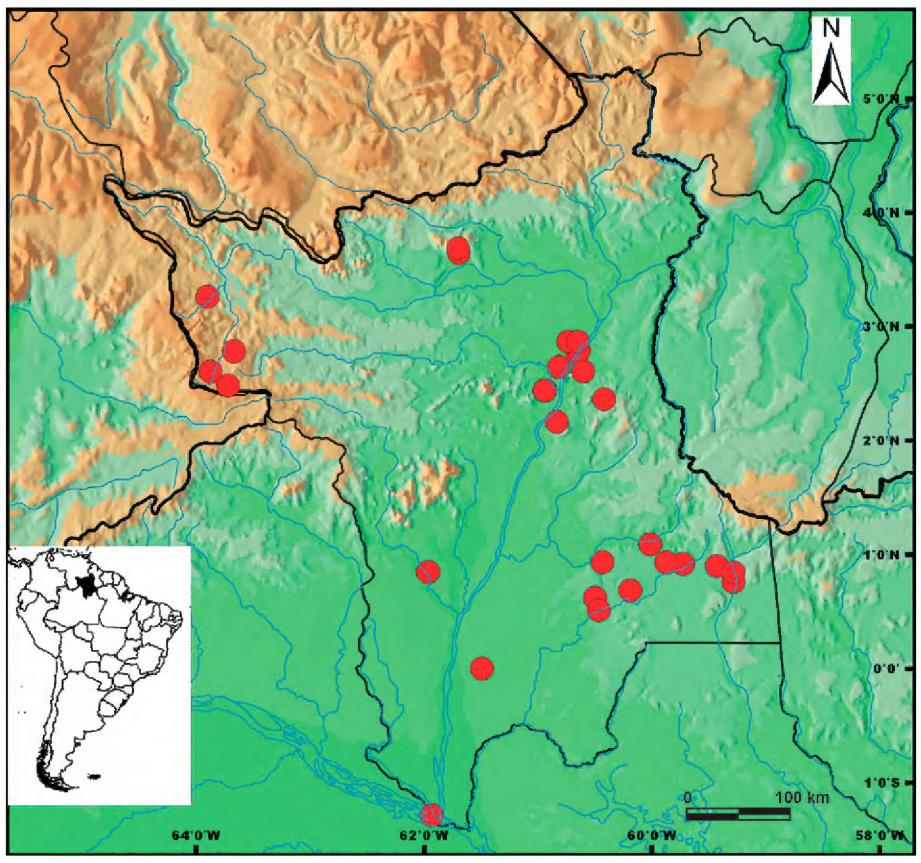

Figure 9. Map showing the distribution of the records of *Macrobrachium brasiliense* (Heller, 1862) in the state of Roraima, Brazil. Some symbols may represent more than one record.

in the Amazon (Figs 6, 7). Both *E. amazoniensis* and *E. burchelli* are widely distributed in the Amazon Basin and have already been recorded in the Negro River basin (Magalhães 1988, Melo 2003, Magalhães and Pereira 2007). *Euryrhynchus wrzesniowskii* also occurs in contiguous hydrographical basins in Guyana (Tiefenbacher 1978) and in the Uatumã River basin, in Brazil (Magalhães 1988).

Macrobrachium is the most diversified genus of Palaemonidae worldwide (De Grave and Fransen 2011) and this is, to a certain extent, reflected in the shrimp fauna of Roraima: with 5 species, the genus is more diverse than *Pseudopalaemon* (2 spp.) and *Palaemon* (1

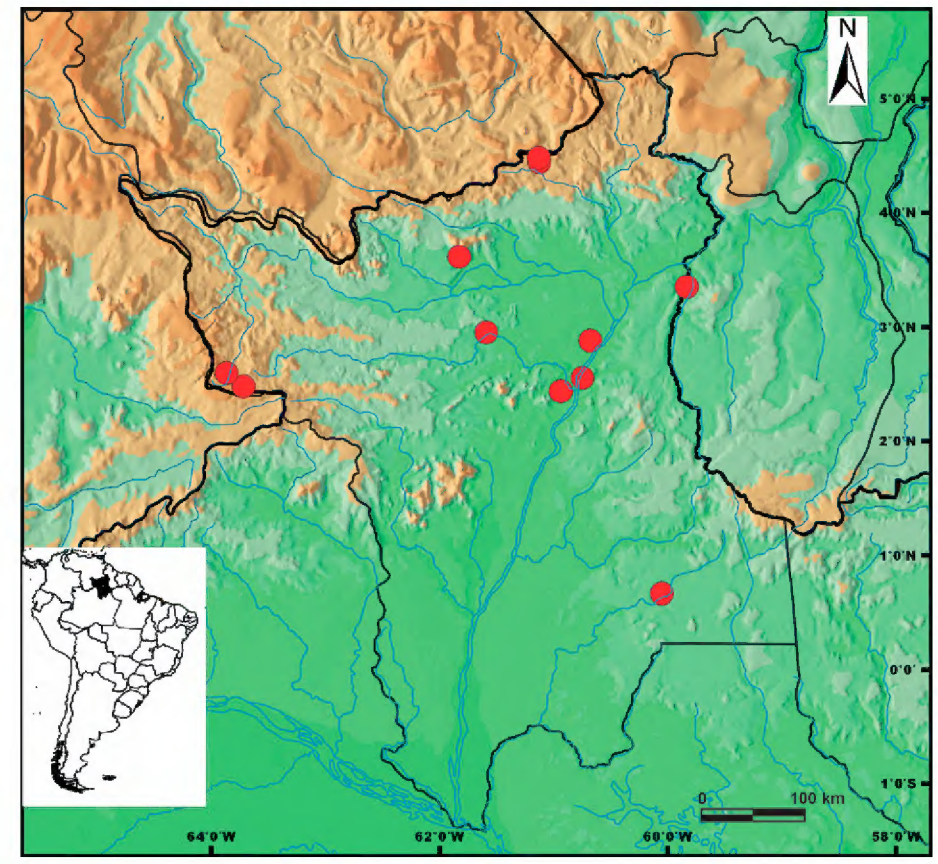

Figure 10. Map showing the distribution of the records of *Macrobrachium nattereri* (Heller, 1862) in the state of Roraima, Brazil. Some symbols may represent more than one record.

sp.). *Macrobrachium nattereri* and *M. brasiliense* are the most widespread species in the state, although *M. nattereri* seems to be restricted to the Branco River drainage whereas *M. brasiliense* is also found in the Jatapu River, a tributary of the Uatumã River, in the southeastern portion of the state (Fig. 9). *Macrobrachium amazonicum* is also present in both Branco River and Jatapu River basins, but its distribution is mainly in the lowland parts, not occurring in the more elevated areas along the mountainous areas in the northern and western part of the state (Fig. 8). According to the present study, *M. jelskii* and *M. ferreirai* have more restricted distribution along or close to the Branco River main channel (Fig. 3). This could be reflective of greater sample efforts in this more easily accessible area as well as a habitat preference for the periodically flooded marginal areas along the lowland course of the river. *Pseudopalaemon chryseus* is widely distributed along the lowland areas of the Branco River drainage (Fig. 12), in contrast to *Ps. gouldingi* which was found only in a tributary of the Tacutu River, near the border with Guyana (Fig. 11). However, *Ps. gouldingi* must have a much wider distribution along the Branco River, as the species is also present in the middle and lower reaches of the Negro River (Kensley and Walker 1982).

Four species of the genus *Palaemon* occur in the Amazon basin (Carvalho et al. 2014). According to these authors, the lineage occurring in the Negro River basin is *P. yuna*, whose distribution was herein extended into the Branco River basin (Fig. 11).

Although the data presented in this study significantly raised the number of species of shrimps with documented occurrences in the state of Roraima from 3 to 12, this number certainly does not encompass the actual richness of the shrimp fauna in the state. Large areas of Roraima are either conservation units or indigenous reserves (EPE

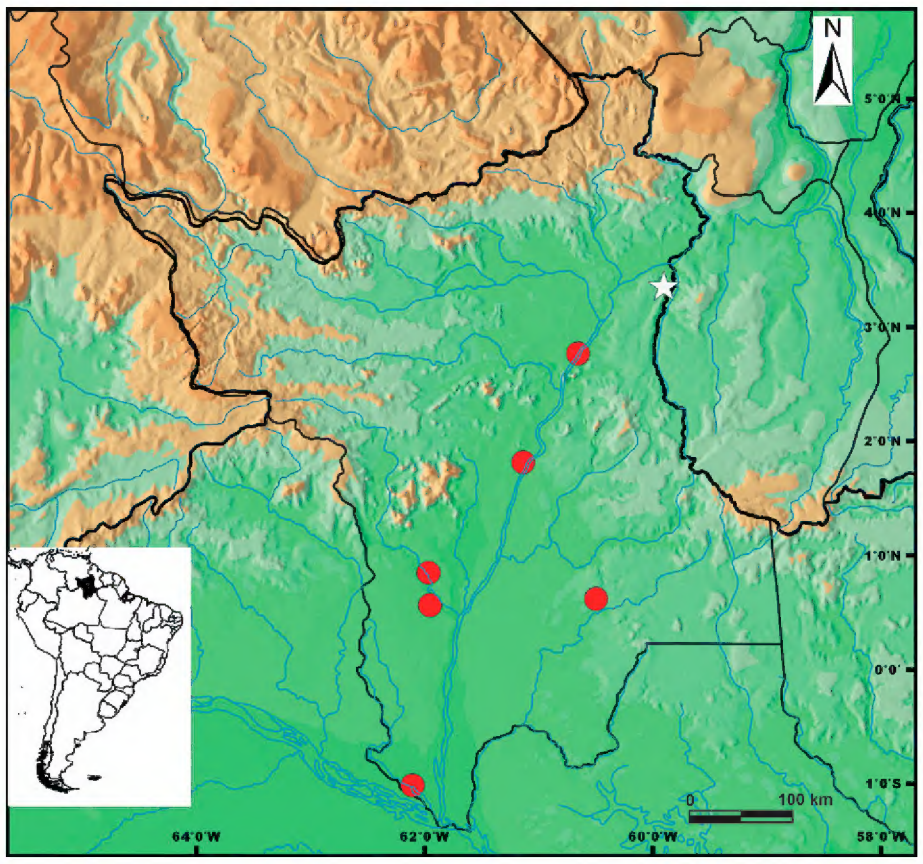

Figure 11. Map showing the distribution of the records of *Palaemon yuna* Carvalho, Magalhães & Mantelatto, 2014 (circle) and *Pseudopalaemon gouldingi* Kensley & Walker, 1982 (star) in the state of Roraima, Brazil. Some symbols may represent more than one record.

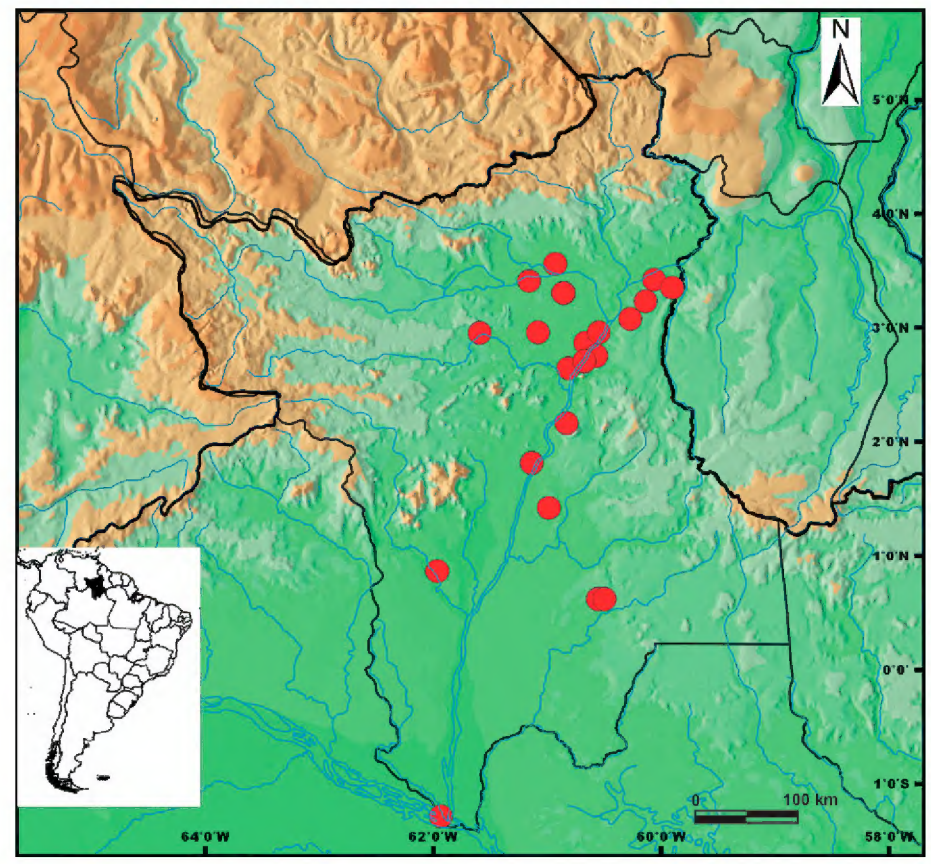

Figure 12. Map showing the distribution of the records of *Pseudopalaemon chryseus* Kensley & Walker, 1982 in the state of Roraima, Brazil. Some symbols may represent more than one record.

2010), and are therefore relatively inaccessible for biological surveys without proper permits and adequate, expensive logistics for the fieldwork. These difficulties are reflected in the distributional maps of the species presented herein (Figs 6–12), where extensive gaps can be noticed, especially in the northern and western portions of the state, encompassing most of the Uraricoera River basin and mainly the right bank tributaries of the Branco River. Figures 6 to 12 show that the occurrences are distributed close to or along the Branco River, in the center and northeastern portions of Roraima, and a few others are distributed in the southeastern portion, thus indicating that collecting efforts are concentrated around the most populated areas, where collecting material is somewhat easier. Taking into account the variety of environments still to be explored in these large areas, it is still premature to have a concrete idea of the richness and distribution of shrimp species in Roraima.

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Authors' Contributions

CM and PMC conceived the study. CM and MALS analyzed the data and composed the figures. All authors contributed data, wrote the paper, and edited the manuscript.

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